

REMARKS/DISCUSSION OF ISSUES

Claims 1-6 are pending in the application. Claims 3-6 are presently amended to delete multiple dependencies.

Applicant thanks the Examiner for acknowledging the claim for priority and receipt of certified copies of all the priority documents.

Applicant thanks the Examiner for acknowledging acceptance of the drawings.

Applicant thanks the Examiner for providing information about recommended section headings. However, Applicant respectfully declines to add the headings. Section headings are not statutorily required for filing a non-provisional patent application under 35 USC 111(a), but per 37 CFR 1.51(d) are only guidelines that are suggested for applicant's use.

Claims 1-6 stand rejected.

Claims 1, 2, 4 and 5 are rejected under 35 USC 102(b) as being anticipated by Culp (U.S. 5,043,621).

Claim 1 calls for an actuator having a plurality of piezoelectric drives and a sphere which is rotatable about at least two axes of rotation, characterized in that at least two piezoelectric drives rotate the sphere about at least two axes of rotation by friction with the aid of vibrations in a tangential direction relative to the surface of the sphere.

In contrast, Culp discloses at least three actuators acting on the sphere, all of which are shear actuators (col. 8, lines 38, 39).

Culp defines three different types of actuators: (a) shear, characterized by an angular displacement  $\theta$  (Figs. 1A and 1B); (b) thickness, characterized by a transverse displacement

$\delta$  (Figs. 6A and 6B); and (c) extension, characterized by a longitudinal displacement  $\delta$  (Figs. 7A and 7B).

The thickness and extension displacements correspond to Applicant's tangential and longitudinal modes of vibration, respectively (see, e.g., page 4, lines 9-14 of Applicant's specification). Longitudinal vibration is not essential to rotation, but merely reduces friction (page 4, line 23). Thus, claim 1 calls only for the combination of friction and tangential vibrations to achieve rotation.

In contrast, Culp uses shear deformations (col. 8, line 49). While he states that shear is the combination of 'lifter' and 'tangenter' portions (col. 8, lines 62, 63), it is clear that these portions are components of the shear deformations, defined by the angle  $\theta$ , and not separate deformations, which would be defined by a linear displacement  $\delta$ .

In contrast, Applicant's claim 1 clearly calls for vibrations in a tangential direction. Such vibrations are linear vibrations, corresponding, e.g., to Culp's thickness vibrations.

Thus, Culp fails to anticipate Applicant's claim 1, which calls for rotation of a sphere by the combination of friction and tangential vibrations.

Claim 2 calls for the piezoelectric drives to operate in any of three modes, tangential, longitudinal and stationary, while claim 4 calls for a first of three drives to operate in the tangential mode, a second to operate in the longitudinal mode, and a third to operate in a switched-off or stationary mode.

In contrast, Culp calls for all of his actuators to operate in the shear mode, which as stated, is a mode characterized by angular, not linear, deformations.

Claim 5 calls for a contact pressure exerted on the drives by the sphere itself, or by a magnet or by a second sphere mounted on the sphere to be rotated.

In contrast, Culp does not disclose that contact pressure can be achieved by a magnet or by a second sphere.

Accordingly, claims 1, 2, 4 and 5 are not anticipated by Culp, and it is urged that the rejection under 35 USC 102(b) is in error and should be withdrawn.

Claim 6 is rejected under 35 USC 103(a) as being unpatentable over Nagata (U.S. 5,946,127) in view of Culp.

Nagata teaches an image pickup apparatus including an image pickup unit in the form of an image sensor mounted inside a hollow ball.

Without conceding the patentability per se of claim 6, it is urged that claim 6 is patentable by virtue of its dependency on claim 1, which is patentable for the reasons already set forth above.

Accordingly, it is urged that the rejection is in error and should be withdrawn.

Claim 3 is rejected under 35 USC 103(a) as being unpatentable over Culp in view of Masaki et al. (U.S. 4,983,875) (herein 'Masaki').

Masaki teaches an actuator structure using a set of piezoelectric motor elements adapted to generate progressive waves in one direction, alternatively arranged with another set of piezoelectric motor elements adapted to generate progressive waves in another direction.

The Examiner has referred to an embodiment in which a sphere is placed in a spherical enclosure, described at col. 6 and shown in Fig. 7

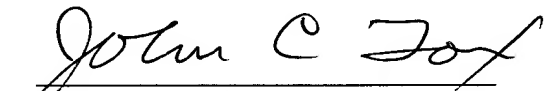
Fig. 7 shows an inner sphere, designated a driving member 4c, and an outer shell or sphere, which is designated a driven member 4d. A ring-like piezoelectric motor element 14 is mounted on driving member 4c, and another motor element 15 is mounted on driven member 4d. Both motor elements 14 and 15 are for driving shell 4d, not inner sphere 4c.

In contrast, claim 3 calls for the piezoelectric drives to be arranged inside the sphere, not on the sphere, and for the piezoelectric drives to drive the sphere, not the shell.

Accordingly, claim 3 is patentable under 35 USC 103(a) over Culp in view of Masaki, and it is urged that the rejection is in error and should be withdrawn.

In view of the foregoing, Applicant respectfully requests that the Examiner withdraw the rejections of record, allow all of the pending claims, and find the application to be in condition for allowance.

Respectfully submitted,

  
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